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ABSTRACT

This Technical Committee Report prepared by industry representatives in Idaho lists the skills currently necessary for an employee in that state to obtain a job in automotive technology, retain a job once hired, and advance in that occupational field. (Task lists are grouped according to duty areas generally used in industry settings, and are used as the basis for modules in the statewide curriculum guide development process and for generating student profiles.) The first section of the guide is the task profile, which provides the Idaho code number for the occupation and outlines major concepts/content, laboratory activities, teaching considerations, intended outcomes, and level of instruction. The guide then lists the following 10 tasks with subtasks (competencies) for automotive technology: shop safety, work ethics and responsibilities, and employability skills; basic knowledge of automotive technicians; electrical and electronic skills for diagnosing malfunctions of electrical/electronic components; engine performance service; engine repair service; automatic transmission/transaxle service; servicing manual drive trains and axles; steering, suspension, and wheel service; automotive brake service; and cooling, air conditioning, and heating service. (KC)

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Vo.Ed. 120T

TECHNICAL COMMITTEE REPORT FOR

AUTOMOTIVE TECHNOLOGY

Invest in Success

IDAHO VTE VOCATIONAL TECHNICAL EDUCATION

STATE DIVISION OF VOCATIONAL EDUCATION

1990

U.S. DEPARTMENT OF EDUCATION
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INTRODUCTION

The curriculum development process undertaken by the Idaho Division of Vocational Education involves the active use of industry personnel. Industry personnel comprise the sole membership on Technical Committees which are responsible for the development of Task Lists for each program. A Technical Committee Report is prepared on completion of the Committee's assignment. This publication is the Technical Committee Report.

The Task List prepared in the Technical Committee Report reflect the current trends and skills necessary for an employee to: 1) Obtain a job in Idaho's industry, 2) retain a job once hired, and, 3) to advance in the occupational field. Task Lists are grouped according to Duty areas generally used in industry settings. Duty areas are used as the basis for modules in the Statewide Curriculum Guide development process. The Technical Committee segment is the single most significant step in the curriculum development process. All future curriculum activities are predicated on the premise that an accurate picture of industry needs are reflected in the Task List.

Instructional personnel are selected to develop the Statewide Curriculum Guide. These instructors write Performance Objectives for each Task and the subsequent Enabling Objectives for each Performance Objective. The committee members prepare all material in a competency-based format so as to have an effective and efficient methodology for determining student progress. The Statewide Guides are designed as the prime determiner of program content. All programs must follow the established Guide in order to be approved for operation. Any deviation from this Guide requires written approval from the respective program supervisor at the Division of Vocational Education. It is not the intent of the Division that all programs be designed to be exactly the same, but assurance is needed to ensure that the program meets the minimum standards for operation, based on the community needs, equipment, and facilities available to the local school or institution.

The Technical Committee Report does not dictate the level of instruction The Task List developed represents the entire occupational field. Schools and Institutions determine what skills can be taught and what depth of instruction can be provided. They must choose the Tasks to be taught from the Technical Committee Report but are free to determine how many or which ones can be incorporated into their program.

The Technical Committee Report is also used as the primary list for generating Student Profiles. These Profiles are used as a cumulative record of each student's progress. They are printed in a folder format and have levels of performance scales for each Task so that student competence can be recorded for individual skills or tasks. This document will become the main component for Articulation activities in the event that the student desires to go on for additional training or education.

ACKNOWLEDGEMENTS

The Technical Committee process involves personnel from industry who are selected by the Division with assistance from the State Council on Vocational Education. People who serve on the Committees are nominated by local administrators. They generally come from local advisory committees for existing Vocational Education programs or are community representatives in a capacity to provide the necessary information about industry needs. These people serve with the approval of their employers and give their time and energies to the project without cost. The Division provides reimbursement for per diem and travel. We are indebted greatly to these industry representatives and to their employers for the resources so freely given to the pursuit of ensuring that Idaho students receive the most current training and education possible and that which is demanded by industry.

To this end, the Division recognizes the following people who served on the Automotive Technician Technical Committee: Ken Reiman, Boise; James McGeachin, Idaho Falls; Dex Hendrickson, Rigby; Richard Tatum, Pocatello; Tom Schmidt, Lewiston; Duane Emergy, Homedale; Bobby Rowell, Caldwell, and Craig Sheets, Boise.

Your support and assistance was very greatly appreciated. Your patience for enduring the educational process is also noted. The students and instructional staff will be much more able to accomplish their respective goals as a result of your contributions.

Sho Ueda, Supervisor
Trades, Industrial & Technical Education

Don Eshelby
Director of Program Services

CURRICULUM FRAMEWORK

PROGRAM AREA: Trade & Industrial

IDAHO DIVISION OF VOCATIONAL EDUCATION

REVISION DATE: January 1991

PROGRAM TITLE: Automotive Technology

IDAHO CODE NUMBER: 6032

CIP#: 47.0604

I. MAJOR CONCEPTS/CONTENT: **The purpose of this program is to prepare students for employment as automobile technicians, engine repair specialist, tansmission and rear axle specialist, front end specialist, brake specialist, electrical system specialist, engine tune up specialist, heating and air conditioning specialist, automobile service station attendant, new and used car get ready technician, or to provide supplemental training for persons previously or currently employed in these occupations.**

The program provides instruction in diagnosis of malfunctions in the repair of engines, fuel, electrical, cooling and brake systems; drive train and suspension systems; and radiators, transmission and carburetors.

The content includes, but is not limited to, communication skills, leadership skills, hjuman relations and employability skills, safe and efficient work practices, basic management concepts, troubleshooting skills, and servicing, maintaining, and repairing all mechanical systems or gasoline and diesel powered automobiles, and related systems.

3. LABORATORY ACTIVITIES: **Shop or laboratory activities are an integral part of this program and provide instruction in theory, fundamentals, service, and rebuilding of the following areas: engine repair, automatic and manual tansmissions, drive trains, steering, suspension, brakes, electrical systems, engine systems performance, and automotive accessories. The tools, equipment, materials, and processes used in the laboratory should be equal to those used in the industry.**

3. SPECIAL NOTE: **The Vocational Industrial Clubs of America Inc. (VICA), is an appropriate vocational student organizaiton for providing leadership training experiences and reinforcing specific vocational skills. When provided, these activities are considered an integral part of this instructional program.**

The cooperative method of instruction is utilized for this program. Whenever the cooperative method is offered, the following is required for each student: a training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on the job and in school learning experiences; a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal.

The particular outcomes and student performance standards which the handicapped student must master to earn credit must be specified in the students' individual educational plan (IEP). Additional credits may be earned when outcomes and standards are mastered in accordance with the requirements indicated in subgsequent IEP's. The job title for which the student is being trained must be designated in the IEP.

4. **INTENDED OUTCOMES: After successfully completing this program, the student will be able to:**

01. Demonstrate Employability skills
02. Basic Automotive Technician Skills
03. Diagnosing/Trouble Shooting Electrical/Electronic Components
04. Engine Performance Service
05. Engine Repair Service
06. Automatic Transmission Trans-Axle Service
07. Manual Drive Train and Axle Service
08. Steering, Suspension and Wheel Service
09. Automotive Brake Service
10. Engine Cooling, Air Conditioning and Heating Service

V. **LEVEL OF INSTRUCTION: The tasks in this program are rated according to the level of skills required for: (a) entry level for employment, (b) retention level for those employed in drafting technology, and (c) advanced level for those skills required of experienced or specialty oriented draftpersons. The following codes represent the skill level of the tasks.**

E Student is introduced to the concepts and is familiar with basic operational functions. This level denotes basic instructional content necessary to enter the job market.

R Student can perform the activity with minimum supervision. This level denotes instructional level necessary to retain a job after obtaining one and work for a short while.

A Student can perform the activity without supervision and will meet industry standards. This level denotes advanced skill training necessary for job retention and promotion.

STUDENT PERFORMANCE STANDARDS EFFECTIVE DATE: January 1991

PROGRAM AREA: Trade and Industrial Education SECONDARY:_____

PROGRAM TITLE: Automotive Technology POSTSECONDARY:_____

01.0 DEMONSTRATE AND APPLY A BASIC KNOWLEDGE OF SHOP SAFETY, WORK ETHICS AND RESPONSIBILITIES, AND EMPLOYABILITY SKILLS
The student will be able to:

- 01.01 Aply shop safety rules and procedures
- 01.02 Apply personal safety rules and procedures
- 01.03 Apply fire safety rules and procedures
- 01.04 Apply electrical safety rules and procedures
- 01.05 Apply rules for hazardous waste disposal
- 01.06 Identify employment opportunities
- 01.07 Apply employment-seeking skills
- 01.08 Interpret employment capabilities
- 01.09 Demonstrate appropriate work behavior
- 01.10 Maintain a business-like image
- 01.11 Maintain working relationships with others
- 01.12 Communicate on the job
- 01.13 Adapt to change
- 01.14 Demonstrate a knowledge of business

02.0 DEMONSTRATE AND APPLY A BASIC KNOWLEDGE OF AUTOMOTIVE TECHNICIANS - **The student will be able to:**

- 02.01 Use and maintain hand tools, such as screwdrivers, special applications pliers,hammers, chisels, punches, special applications wrenches and sockets, files, hack saws, bench vises and C-clamps
- 02.02 Demonstrate use of precision measuring tools
- 02.03 Apply basic welding skills related to the automobile industry
- 02.04 Use and maintain power tools, such as drills, bench grinders, drill presses, hydraulic presses, impact wrenches, air chisels, parts washers, hydraulic jacks and vehicle hoists
- 02.05 Use basic electrical equipment and meters
- 02.06 Use and install fasteners, such as screws and bolts, key screw extractors, helicoil inserts and thread cutting tap and dies
- 02.07 Apply basic math skills
- 02.08 Apply metric math skills
- 02.09 Service vehicle with proper automotive lubricants
- 02.10 Demonstrate the use of shop manuals and tune-up charts
- 02.11 Demonstrate a knowledge of automotive tubing types and sizes
- 02.12 Demonstrate skill in electrical soldering
- 02.13 Define electrical terms

02.14 Understand and apply the rules of series circuits
02.15 Understand and apply the rules of parallel circuits
02.16 Understand and apply the rules of series-parallel circuits
02.17 Define steering geometry and suspension geometry
02.18 Explain the function of steering and suspension system components
02.19 Explain and describe the components of manual and power steering
02.20 Describe drum brake operation
02.21 Describe disc brake operation
02.22 Describe operation of brake system valves
02.23 Explain proper brake pedal height
02.24 Demonstrate a knowledge of basic automotive engine cooling systems
02.25 Demonstrate a knowledge of automotive heating and air conditioning systems
02.26 Demonstrate knowledge of different wire sizes and different terminal ends
02.27 Demonstrate a knowledge of automotive ignition and fuel system
02.28 Describe rear axle operation
02.29 Describe drive shaft operation
02.30 Describe automatic transmission and trans-axle operation
02.31 Describe clutch operation
02.32 Describe clutch release linkage mechanisms
02.33 Describe manual transmission trans-axle operation
02.34 Describe 4 X 4 transfer case systems
02.35 Demonstrate a knowledge of the internal combustion engine, both diesel and gasoline

03.0 APPLY ELECTRICAL AND ELECTRONIC SKILLS IN DIAGNOSING/ TROUBLESHOOTING MALFUNCTIONS OF ELECTRICAL/ELECTRONIC COMPONENTS (Computerized or Non-computerized) - The student will be able to:

03.01 Demonstrate and apply safety rules and procedures
03.02 Diagnose electrical engine malfunctions
03.03 Perform power checks
03.04 Measure voltage drop, current flow, continuity and resistance in a circuit or component
03.05 Locate an open circuit or a short circuit
03.06 Analyze cranking system malfunctions
03.07 Analyze charging system malfunctions
03.08 Service and test batteries
03.09 Remove and replace light bulbs
03.10 Inspect, remove, and replace alternator belts
03.11 Test, remove, and replace fuses and circuit breakers
03.12 Replace and test starters
03.13 Test and overhaul alternators
03.14 Remove and replace regulators
03.15 Inspect and repair lighting systems
03.16 Diagnose, repair or replace turn signal and stop light switches
03.17 Test and replace electrical system switches

03.18 Diagnose, repair, or replace power window and power seat systems, including motors
03.19 Diagnose, repair, or replace horn systems
03.20 Diagnose, repair, or replace clock systems
03.21 Diagnose, repair, or replace warning buzzer
03.22 Test and replace instrument panel units
03.23 Service or repair windshield wiper/washer systems
03.24 Test and replace electronic control units
03.25 Check, remove, and replace radios

04.0 DEMONSTRATE PROFICIENCY IN ENGINE PERFORMANCE SERVICE
The student will be able to:

04.01 Demonstrate and apply safety rules and procedures
04.02 Analyze engine performance
04.03 Perform cylinder compression tests
04.04 Check the performance of engines equipped with on-board computers
04.05 Inspect, remove, and replace points and condensers
04.06 Remove and replace distributors
04.07 Check distributors using a distributor tester
04.08 Check the distributor advance in a vehicle
04.09 Overhaul distributors
04.10 Inspect and test primary circuits
04.11 Remove and replace coils
04.12 Remove and replace ignition switch
04.13 Inspect, remove, and replace ignition wires, caps, and rotors
04.14 Remove and replace spark plugs
04.15 Perform cylinder leakage tests
04.16 Service electronic ignition systems
04.17 Service oxygen feedback systems
04.18 Service air cleaners
04.19 Inspect, remove, and replace fuel filters
04.20 Measure fuel flow and pressure
04.21 Remove and replace fuel lines
04.22 Remove and replace fuel pumps, mechanical and electrical
04.23 Adjust idle speed
04.24 Adjust idle mixture (propane)
04.25 Clean and adjust choke and check proper operation of electrical choke
04.26 Clean and overhaul carburetors
04.27 Inspect, remove, and replace manifold control valve
04.28 Remove and replace turbochargers
04.29 Check and adjust waste gate
04.30 Set idle speed to specification (fuel injection)
04.31 Remove and replace fuel injectors
04.32 Service throttle body injection system
04.33 Service ported fuel injection
04.34 Service PCV system

04.35 Service evaporative control system
04.36 Service thermostatic air cleaner
04.37 Service air injection system
04.38 Inspect, remove, and replace air-pump belts
04.39 Service Exhaust Gas Recirculation (EGR) systems
04.40 Service ignition timing controls
04.41 Test exhaust emission using an HC/CO tester
04.42 Remove and replace catalytic converter beads
04.43 Service diesel injectors
04.44 Remove and replace diesel engine fuel filters and water separator, if one has been added
04.45 Check and adjust injection pump timing
04.46 Remove and replace injection pump
04.47 Check and adjust idle and maximum speeds
04.48 Test and service pre-heat system
04.49 Diagnose diesel fuel emission problems
04.50 Inspect exhaust system
04.51 Remove and replace tail pipe
04.52 Remove and replace muffler
04.53 Remove and replace exhaust pipe
04.54 Inspect, remove, and replace catalytic converter

05.0 DEMONSTRATE PROFICIENCY IN ENGINE REPAIR SERVICE

The student will be able to:

05.01 Demonstrate and apply safety rules and procedures
05.02 Perform running compression tests
05.03 Perform cylinder compression tests
05.04 Perform cylinder leakage tests
05.05 Clean engines
05.06 Determine source(s) of oil loss
05.07 Determine source(s) of coolant loss
05.08 Determine source(s) of excess noise
05.09 Determine cause(s) of over-heating
05.10 Check the engine oil pressure
05.11 Remove and replace motor mounts
05.12 Remove and replace core plugs
05.13 Inspect and measure flywheel runout
05.14 Remove and replace flywheel
05.15 Remove and replace flywheel ring gear
05.16 Remove and replace engine assemblies
05.17 Remove and replace oil pans
05.18 Remove and replace oil pumps
05.19 Clean cylinder blocks, oil passages, and pistons
05.20 Inspect blocks for warpage
05.21 Measure and inspect engine components for proper tolerances
05.22 Remove and replace crankshafts, mains, and rod bearings

05.23 Remove and replace camshafts
05.24 Remove and replace camshaft bearings
05.25 Remove and replace pistons and rings
05.26 Remove ridges and deglaze cylinder walls
05.27 Remove and replace front and rear oil seals
05.28 Remove and replace intake and exhaust manifolds
05.29 Remove, clean, inspect and replace cylinder heads; and inspect head for cracks and warpage
05.30 Test and replace hydraulic lifters
05.31 Pressure test hydraulic lifter
05.32 Reface valve and seats
05.33 Check valve guides for wear
05.34 Remove and replace timing chains and gears
05.35 Remove and replace timing belt
05.36 Test valve springs
05.37 Adjust valve lifters
05.38 Replace rocker-arm assemblies, inspect wear and lubrication
05.39 Change oil and oil filters with proper application

06.0 **DEMONSTRATE PROFICIENCY IN AUTOMATIC TRANSMISSION/ TRANS-AXLE SERVICE - The student will be able to:**

06.01 Demonstrate and apply safety rules and procedures
06.02 Check automatic transmission fluid levels
06.03 Performance test automatic transmissions
06.04 Diagnose malfunctions of automatic transmissions
06.05 Diagnose, repair, and replace trans-axles
06.06 Pressure test transmissions in vehicles
06.07 Stall test transmissions in vehicles
06.08 Change transmission oil and filter
06.09 Adjust linkage from the engine
06.10 Adjust shift linkage
06.11 Test the electrical and computer controls of an automatic transmission and clutch converter
06.12 Adjust neutral safety switches
06.13 Remove and replace external gaskets and seals
06.14 Test vacuum shift modulators
06.15 Adjust bands
06.16 Service governors
06.17 Service valve bodies
06.18 Rebuild transmission assemblies
06.19 Pressure flush converter assemblies
06.20 Pressure flush transmission cooler assemblies and check liquid flow
06.21 Remove and replace extension housings and bushings

07.0 **DEMONSTRATE PROFICIENCY IN SERVICING MANUAL DRIVE TRAINS AND AXLES - The student will be able to:**

- 07.01 Demonstrate and apply safety rules and procedures
- 07.02 Diagnose drive line problems
- 07.03 Diagnose and performance test manual transmission problems
- 07.04 Inspect drive shafts, U-joints, and center bearings
- 07.05 Lubricate universal joint
- 07.06 Check the fluid level in a manual transmission
- 07.07 Check the fluid level in a differential
- 07.08 Remove and replace transmission mount(s)
- 07.09 Adjust shift linkage
- 07.10 Adjust clutches
- 07.11 Remove and replace extension housing seal and bushings
- 07.12 Rebuild manual transmission
- 07.13 Remove and replace clutches, release bearings, linkage, and pilot bearing
- 07.14 Rebuild clutch master and slave cylinders
- 07.15 Remove and replace universal joints
- 07.16 Remove and replace speedometer gears and service speedometer cables
- 07.17 Remove and replace axle bearings and seals
- 07.18 Overhaul integral differentials
- 07.19 Overhaul removable differentials
- 07.20 Overhaul limited slip differentials
- 07.21 Overhaul transaxle assemblies
- 07.22 Adjust transaxle shifting controls
- 07.23 Inspect, remove, replace, and lubricate front-drive-axle flexible joints
- 07.24 Inspect, remove, replace constant velocity universal joints, and balance
- 07.25 Service or repair transfer case and vacuum control

08.0 **DEMONSTRATE PROFICIENCY IN STEERING, SUSPENSION, AND WHEEL SERVICE - The student will be able to:**

- 08.01 Demonstrate and apply safety rules and procedures
- 08.02 Diagnose abnormal tire wear problems
- 08.03 Diagnose suspension problems
- 08.04 Diagnose wheel/tire vibrations, shimmy, and tramp
- 08.05 Diagnose steering problems
- 08.06 Lubricate suspension, steering gear, and linkage
- 08.07 Check manual steering gear fluid level
- 08.08 Inspect steering systems
- 08.09 Inspect suspension systems
- 08.10 Inspect and test shock absorbers and auto leveling system
- 08.11 Check power steering fluid level
- 08.12 Replace power steering drive belts
- 08.13 Identify tires by types and sizes
- 08.14 Repair tires
- 08.15 Rotate wheels and tires and torque lug nuts to specification

08.16 Balance tires by computer, bubble, or spin
08.17 Service front wheel bearings and grease seals
08.18 Remove and replace front and real wheel bearings
08.19 Remove and replace spindles and ball joints
08.20 Remove and replace shock absorbers and mountings
08.21 Measure and adjust torsion bar height
08.22 Remove and replace torsion bars
08.23 Remove and replace coil springs
08.24 Remove and replace control arms and bushings
08.25 Remove and replace steering linkage components
08.26 Remove and replace McPherson strut assembly
08.27 Rebuild a McPherson strut
08.28 Remove and replace rear suspension parts including independent suspension
08.29 Remove and replace mast jacket of steering assembly
08.30 Repair steering column
08.31 Remove and replace steering wheel
08.32 Remove and replace components in power steering system
08.33 Check two-wheel and four-wheel alignments
08.34 Align rear axle

09.0 DEMONSTRATE PROFICIENCY IN AUTOMOTIVE BRAKE SERVICE
The student will be able to:

09.01 Demonstrate and apply safety rules and procedures
09.02 Diagnose brake system problems
09.03 Diagnose pressure differential valve malfunctions
09.04 Diagnose proportioning valve malfunctions
09.05 Diagnose metering valve malfunctions
09.06 Perform operational inspections
09.07 Inspect brake and wheel assemblies and perform proper cleaning procedures
09.08 Remove and replace calipers and rotors, front and rear
09.09 Refinish rotors on or off car, and torque lug nuts to specification
09.10 Clean, inspect and rebuild calipers
09.11 Refinish brake drums and torque lug nuts to specifications
09.12 Replace drum brake shoes with proper materials
09.13 Service and/or replace brake pads
09.14 Adjust brake shoes
09.15 Adjust parking brakes
09.16 Rebuild or replace wheel cylinder
09.17 Bleed hydraulic brakes
09.18 Free up or replace parking brake cables and linkage
09.19 Remove and replace/overhaul master cylinder
09.20 Flush brake systems
09.21 Test and replace vacuum brake power unit
09.22 Test and replace hydro-booster
09.23 Test brake anti-lock system
09.24 Remove and replace anti-lock system components

10.0 **DEMONSTRATE PROFICIENCY IN COOLING, AIR CONDITIONING, AND HEATING SERVICE - The student will be able to:**

10.01 Demonstrate and apply safety rules and procedures
10.02 Inspect, remove, and replace drive belt(s)
10.03 Check radiator coolant level
10.04 Test and replace coolant
10.05 Pressure-test cooling systems
10.06 Test radiator caps
10.07 Inspect, remove, and replace radiator and heater hoses
10.08 Remove, test, and replace thermostats
10.09 Flush cooling system
10.10 Remove and replace radiators
10.11 Remove and replace water pumps
10.12 Inspect and pressure-test air conditioning system
10.13 Discharge, evacuate, and charge basic air conditioning system
10.14 Leak-test basic air conditioning systems
10.15 Service air conditioning electrical circuits
10.16 Service air conditioning vacuum circuits
10.17 Remove and replace components in basic air conditioning systems
10.18 Remove and replace engine fan clutches
10.19 Remove and replace blower motors
10.20 Remove and replace heater cores, control units, and cables
10.21 Remove and replace compressor shaft seals
10.22 Service engine electric cooling fan and controls

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